

28 March 1963

Dear John,

After our visit to your place, we left with the intention to think about the problems a little bit. At the request of John P. and Jack this letter will serve as a preliminary report on our present progress. First, we are still quite concerned about the resolution limit of your viewing equipment. The equipment we saw had a transfer function limit of approximately 250 lines, and this assures very considerable contrast loss at 200 l/mm. With this in mind I looked quite critically at the equipment on display at the ASP convention, and I find that this kind of performance limitation is quite general.

The obvious approach to circumvent these difficulties is to enlarge the 200 line photograph by several diameters so that the 200 lines become something like 50, or fewer, l/mm. At these lower spatial frequencies, the transfer function of the viewing equipment is higher, but there is still loss of modulation. To try to find out if presently contracted equipment might be better, I called Ed Green and requested him to provide the transfer function of the enlarger he is at work on. He has not replied to this request and perhaps won't, so I would very much appreciate it if you could help us obtain this information, as any recommendation we make to you would be unintelligent to the extent that we did not have accurate information on which to base recommendations. Also, in this connections, we left a high contrast Air Force target and three sine wave targets with Jack, requesting that you provide us enlargements with your existing equipment; and we will then measure the enlarged images to determine the transfer function of that equipment.

While we do not yet have completely full information on which to base specific proposals to assist with all problems, we are proceeding with five efforts of which you should be aware:

1. Proposal to study reversal processing. We have revised a proposal to study reversal processing and re-submitted it to John P. This program would be carried out by Frank Scott and we believe that it might result in a method to provide you with slightly better original positives. Since the original positive would have to be reproduced to make the many duplicate positive work copies you require, we have altered the proposed study to include a section on making duplicate positives from the original positive, also by reversal processing. This proposal now awaits your decision and we plan no future action in this regard until we hear from you.
2. We are proceeding to make, with company money, a demonstration prototype of a micro-enlarger. This is the instrument I described to you verbally a few weeks ago. It should be

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finished in about two to three months.

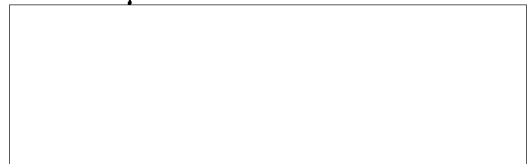
3. The skew pneumatic bar light table, to present the film laterally displaced for stereo viewing, is progressing fairly well and should be in operation within the month.

4. High quality optical viewer. In this area we are a little nebulous at the moment, although the need for something obviously exists. Originally I thought a two person stereo microscope would be a useful device, but my experiments, on company funds, lead me to the conclusion that there is too much power in a microscope to get a good stereo effect (for me at least). On the other hand I believe you would find quite useful a two person microscope of high quality, such that one person could point out to another an object requiring study. I believe that your thoughts on this would be most helpful to us in framing a meaningful requirement.

5. A very high quality enlarger for a fairly large area of film (say 70 mm x 70 mm) seems to us to be required. If we choose to make this conventionally, then the enlarger lens must be faster than  $f/1$  and diffraction limited to provide 0.95 transfer at 200 l/mm. However, if we use coherent light and achieve the diffraction limit, then the enlarger lens need only be  $f/4$ , which is quite reasonable. In fact, we have such a lens design. (This lens was developed under an Air Force contract and is presently being fabricated in an 18" focal length version for the A3J program.) We are studying the tolerances on this lens, at the moment, to see whether we can reasonably be expected to make it to the perfection required to achieve the 1.00 transfer function which is theoretically possible at 200 lines. A very useful bi-product of the coherent light approach is that the enlarger would have in it a location at which spatial filtering could be done, thus providing a correction for image motion, atmospheric seeing, or other known defects, and could also provide edge enhancement. I believe we will be able to discuss this intelligently with you when you visit.

I think this should bring you up to date on our thinking and indicate the areas where we believe our contribution is limited by uncertain knowledge of your requirements. We look forward to seeing you and any of your people who you feel should visit.

Best regards



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